



# A 23 years audit of packed red blood cell consumption in a university hospital in a developing country



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## ABSTRACT

**Background:** There is paucity of information on the blood transfusion practice in developing countries. The current audit aims to find out the long term trend in the consumption of packed red blood cells (PRBCs) in a large Saudi teaching hospital in Riyadh

**Materials and methods:** We analyzed the annual consumption of PRBCs from 1985 to 2007 in seven major hospital divisions (Medicine, General Surgery, Pediatrics, Obstetrics and Gynecology, Cardiac Surgery, Accident and Emergency and Renal Dialysis Unit) at the 850-bed King Khalid University Hospital (KKUH), Riyadh.

**Results:** Grand total consumption of PRBCs was 345,642 units. The consumption increased gradually and peaked in the year 1994, dropped to 30.4% 6 years later and then increased gradually thereafter, due to the expansion in the number of patients cared for in the Departments of Medicine, Cardiac Surgery and Accident and Emergency, while in the Department of Pediatrics the drop in consumption continued unabated. In the Renal Dialysis Unit consumption was minimal with the use of erythropoietin therapy. The crossmatch:transfusion ratio uncovered gross over-ordering of PRBCs and wastage of blood bank resources in most hospital divisions most notably in the Department of Obstetrics and Gynecology.

**Conclusion:** The results obtained indicate clearly that there has been overuse of blood products that dropped markedly in years coinciding with the worldwide apprehension about the safety of transfusion therapy particularly HIV transmission. This factor in addition to the current implementation of strict guidelines is gradually improving transfusion practices in our institute.

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## 1. Introduction

The blood transfusion service in The Kingdom of Saudi Arabia (KSA) is a hospital-based blood banking system where

every hospital blood bank is responsible for the whole service from the recruitment of donors, collection and testing of donated blood, preparation of various components, their storage and issue in response to the request of the treating physicians. In all hospital blood banks there are written broad guidelines for transfusion of all blood products, with detailed information on individual blood products, the indication for their use, recommended doses and the risks their administration carries. At a time when blood transfusion is a well-established form of therapy there is lack of good scientific evidence to support the current practice for the transfusion of various blood components which seems to

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be determined more by the conviction of attending physicians than strict guidelines [1].

However, information is lacking neither locally or in our geographical region, on the transfusion practices, in particular, long term trend in the consumption of blood products and whether such factors as guidelines or concern on the safety of hemotherapy, and their possible impact on the consumption of blood components. Such information will no doubt be potentially useful to uncover the extent of the unnecessary transfusion given to patients and to ensure the more appropriate use of limited transfusion resources.

**Aim of the study:** This study is a 23 years (1985–2007) audit of the use of packed red blood cells (PRBCs) at King Khalid University Hospital (KKUH), Riyadh, aiming to find out the change in the pattern of consumption over a lengthy period with the attitude to transfusion of blood derivatives we assumed to have been affected by two major factors, the HIV 'scare' and the issue of guidelines.

## 2. Materials and methods

KKUH is an 850-bed general hospital and is the main teaching hospital of the College of Medicine, King Saud University, Riyadh. It is the largest teaching hospital in Saudi Arabia and the Gulf States. It has 33 clinical divisions including Accident and Emergency (A & E), Cardiac Surgery, Hematology/Oncology, Medical, Surgical and Neonatal Intensive Care Units. The hospital is served by a Hospital Blood Bank that has the responsibility of recruiting donors, collecting and testing of donated blood, and the issue of blood derivatives, including PRBCs, platelet concentrate, fresh frozen plasma, cryoprecipitate as well as filtered and irradiated components to special patient groups. The packed RBCs analyzed in this survey are non-additive packed RBCs prepared from whole blood after centrifugation and subsequent removal of approximately 250 ml plasma. There is a Hospital Blood Transfusion Committee that issues *Guidelines to the Transfusion of Blood and its Derivatives* in booklet form which is updated at regular intervals. The hospital records have undertaken a gradual modernization to the current fully computerized hospital management system, which facilitated the storage and retrieval of a variety of databases including the blood bank data. The information presented in this paper extends what was initially presented in the 27th Congress of the International Society of Blood Transfusion (ISBT), held in Vancouver in 2002 and published in abstract form [2].

The annual consumption of various blood derivatives by the following major clinical departments: General surgery, Medicine (including Hematology/Oncology), Renal Dialysis Unit, Pediatrics, Obstetrics and Gynecology and Cardiac Surgery, was recorded retrospectively over a 23 year period, 1985–2007. The total numbers of PRBC units cross-matched and transfused, in addition to the cross-match/transfusion ratio, were calculated for each hospital unit. Until this date the KLUH does not offer complex medical services such as solid organ transplantation, complex cardiac surgery, stem cell transplantation.

This study has received ethical approval from the Institutional Review Board (IRB) of the College of Medicine, King Saud University, Riyadh.

### 2.1. Statistical analysis

The analysis is intended to be an exploratory analysis concerned with identifying station(s) where significant changes in the trend of the consumption of PRBCs (increasing, decreasing or remain unchanged) over long time interval (23 years), quantify these findings and testing for their significance, at the 5% level. As the change in consumption is not expected to be linear from year to year (with no correlation between measurements collected at different times), we employed the Mann–Kendall Test For Monotonic Trend (MK test) [3], rather than parametric linear regression analysis which requires that the residuals from the fitted regression line be normally distributed; an assumption not required by the MK test.

Linear trend (median drop per year in PRBC administration conducted) was assessed using the robust linear regression Theil–Sen estimator [4]. The choice of this technique was based on the fact that it is significantly more accurate than simple linear regression for skewed and heteroskedastic data and compares well against non-robust least squares even for normally distributed data in terms of statistical power. Strength of the trend was assessed using the MK test statistic.

## 3. Results

Over the 23 year period of this survey the total number of transfused PRBC units at KKUH was 33,374 units. The total consumption increased gradually in the same time frame as the gradual increase in the total number of patients admitted to KKUH (Fig. 1), reaching a plateau in the ninth year after the start of the records and then remained hardly changed for the next 4 years after which it dropped dramatically from 18,451/year in the year 1994 to its lowest level (12,838/year) 4 years later in the year 1998; representing a dramatic drop of 30.4%. Thereafter, there was a gradual increase to a maximum of around 17,000 unit PRBCs/year in the years 2005–2007.

As to the total number of patients been admitted to KKUH during the study period, total number of admissions increased gradually from over 20,000 in 1985 to 32,000 10 years later and to just under 34,000 in 1996 and remained stable up to 2007 (Fig. 1). The mortality rate showed slight but not a significant drop around the mid to late 1990s (Fig. 2).

We then looked into the consumption of individual department to see whether any inter-departmental variations in consumption can be associated with the trend in hospital total PRBC consumption over the 23 years of the study. The results obtained were as follows (Fig. 3):

- The consumption of PRBCs in the Departments of Medicine and Cardiac Surgery increased gradually and peaked in the year 1993–1994 and then gradually dropped by approximately half 6–7 years later (47.1% and 51.7%, respectively), reaching the lowest level in the years 1999 and 2001 respectively. In subsequent years it showed gradual but continuous rise up to 2007.
- In the Department of General Surgery a similar drop in consumption was noted reaching its lowest level in the

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